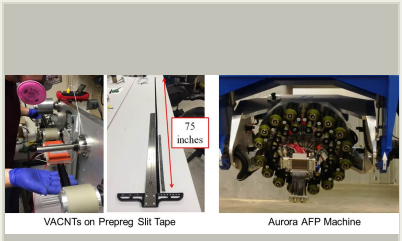
Benefit Analysis of Hybrid CNT/CFRP Composites in Future Aircraft Structures, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

During Phase I, Aurora Flight Sciences and N12 Technologies propose to conduct a comprehensive analysis of the benefits of hybrid composites in future aircraft structures by leveraging analytical model and experimental results that Aurora has gathered during the development of its indigenous Orion unmanned aircraft system, which utilizes CFRP composites in the majority of its structure. Target areas that are critically loaded and/or include features such as embedded sensors and de-icing mechanisms, will be used to evaluate improvements in weight, lifecycle costs, performance, and reliability that CNTs can provide as a result of their multifunctionality. The analysis will be extended during Phase II to study the effect of hybrid composite utility on commercial aircraft (e.g. Boeing 737) using codes such as TASOPT that redesigns aircraft to optimize parameters including fuel efficiency and emissions. Phase II will also involve the design, build, and testing of hybrid composite specimens to prove out the benefits identified during Phase I. Relevant CNT data will be provided by N12 to ensure the greatest amount of accuracy in the benefit analysis. N12 is a spin-off from MIT Professor Brian Wardle's laboratory, that is capable of directly integrating vertically aligned CNTs with common aerospace-grade carbon prepreg materials and conventional processes used to manufacture primary aerospace structures (e.g. hand layup, automated fiber placement (AFP), automated tape layup (ATL)). N12 grows CNTs with controlled morphology and top-to-bottom alignment using an IP-protected continuous, high throughput process that is 1,000 times faster than common batch processes. These CNTs can similarly be transferred onto the surface of carbon prepreg materials in a continuous process that enables a seamless, low cost integration of CNT-reinforced CFRP prepreg with common manufacturing processes to enable future lightweight, multifunctional composite aircraft structures.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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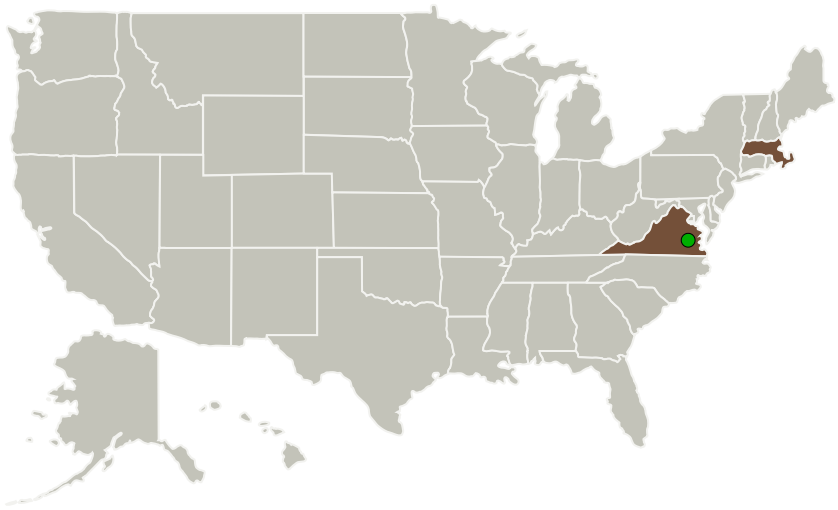
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Massachusetts	Virginia

Project Transitions

June 2015: Project Start

December 2015: Closed out

Closeout Summary: Benefit Analysis of Hybrid CNT/CFRP Composites in Future Aircraft Structures, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138843)*

Project Management

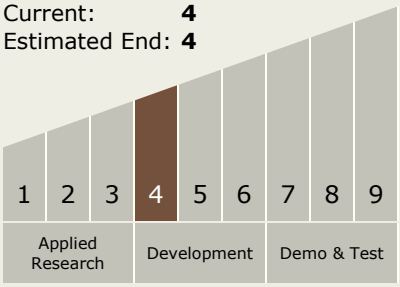
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Konstantine Fetfatsidis

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System

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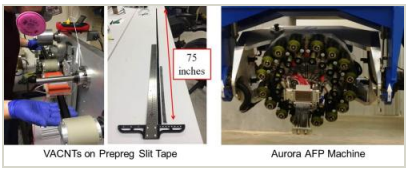
Images



Briefing Chart Image
Benefit Analysis of Hybrid CNT/CFRP Composites in Future Aircraft Structures, Phase I
(https://techport.nasa.gov/image/130493)